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Slaughter Inspection
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Technical Services

Washington, D.C.
20250

June 1989

Gongylonema Pulchrum in Swine Tongues

E. Ciolfi, D.V.M.

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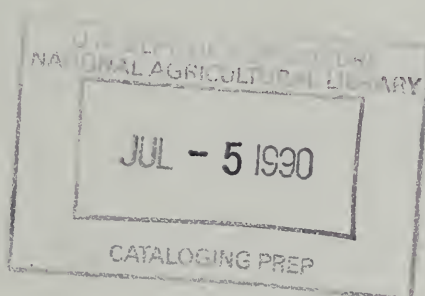


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GONGYLONEMA PULCHRUM IN SWINE TONGUES

An Inplant and Laboratory Study

E. Ciolfi, D.V.M.



June 1989

United States Department of Agriculture
Food Safety and Inspection Service
Technical Services
Slaughter Inspection Standards and Procedures Division
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SUMMARY

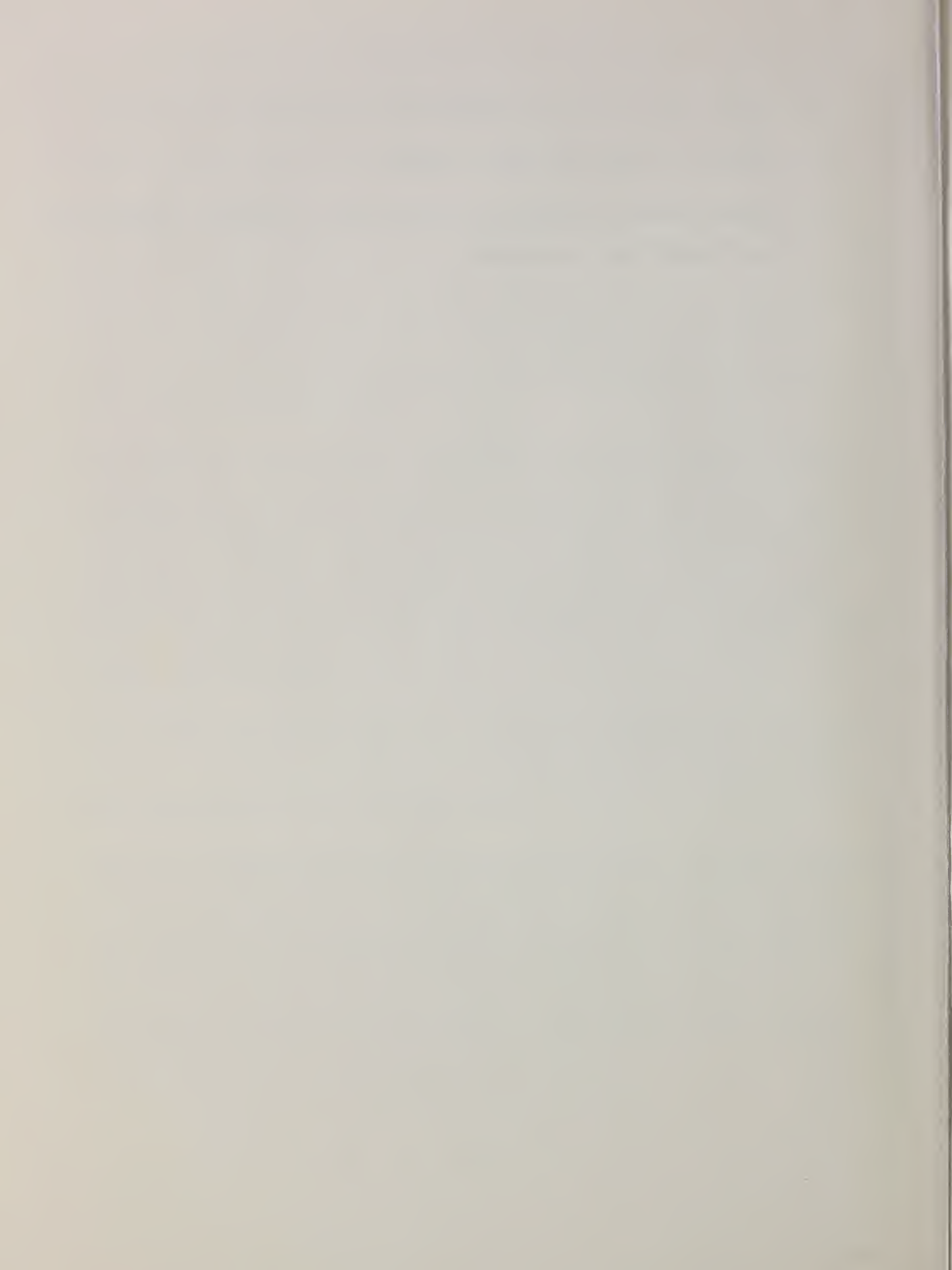
The Slaughter Inspection Standards and Procedures (SISP) Division conducted a study on the incidence of the threadworm *Gongylonema pulchrum* (*G. pulchrum*) in swine tongues between April 27, 1987, and June 30, 1989. This study assessed the incidence of *G. pulchrum* in carcasses of swine, which were from 32 States and two Canadian provinces, and were slaughtered in 12 plants located in various areas of the United States.

The study included inplant evaluations of 48,000 tongues, randomly selected from 210,650 carcasses, and evaluations of 4,800 tongues, which were examined, scalded, and re-examined while the mucosa was manually peeled off. Also, the study included histopathological examinations of specimens from 960 randomly selected tongues-- 820 normal and 140 suspect.

All inplant evaluations and most laboratory examinations were negative for *G. pulchrum*. Only two specimens from the suspect tongues were found positive by the laboratory.

The United States Department of Agriculture(USDA) requires scalding of swine tongues before they are used as edible product. The reason for scalding is to remove the mucous membrane and assure that *G. pulchrum*, if present, is also removed. Since this worm is non-infectious to man and its incidence in the United States is now insignificant, it is recommended that USDA :

1. Delete the requirement in the Meat and Poultry Inspection Manual to scald all swine tongues.
2. Emphasize the reinspection requirements including examination of tongues for threadworms.



INTRODUCTION

Preliminary feasibility studies, conducted by the Slaughter Inspection Standards and Procedures(SISP) Division on swine tongues, revealed that all examined tongues were free of Gongylonema pulchrum (G. pulchrum) infestations. This indicated that the requirements of scalding the tongues to remove the mucosa could be eliminated without affecting the wholesomeness of the product and the effectiveness of consumer protection.

As a result of these studies, SISP conducted an extensive study between April 27, 1987, and June 30, 1989, to determine the national incidence of G. pulchrum in swine tongues and whether the scalding requirements, promulgated in the Meat and Poultry Inspection Manual, were appropriate for the actual incidence of this worm in the United States. This study involved 12 plants: six large-size market hog plants, one medium-size sow/boar plant, and five medium/small-size plants slaughtering mainly market hogs and some sows and boars.

During this study, the tongue inspection and reinspection procedures were not changed nor evaluated. Therefore, the study only included evaluations of the tongues to detect G. pulchrum. Also, during the inplant activities, laboratory samples were selected and submitted to the Pathology and Epidemiology Division(PED), Science, for histopathological examinations. Upon completion of the inplant evaluations, SISP summarized the data and PED performed the laboratory examinations.

This report briefly explains why the study was conducted, describes the methodology used, and presents findings and conclusions of the study, which tested the hypothesis that " the incidence of G. pulchrum in swine tongues is actually insignificant in the United States and the scalding requirements for swine tongues are no longer appropriate.

OBJECTIVE

The objectives of the study were to:

- o Identify the most probable infested areas of the United States.
- o Design and develop feasible and effective methods of evaluation.
- o Select and evaluate an adequate number of tongues based on the hogs slaughtered.
- o Collect adequate data and determine:
 - a. The incidence and significance of threadworms in tongues of swine slaughtered in the United States.
 - b. If swine tongues need to be scalded to be used as edible product.
 - c. If the scalding requirements outlined in the Meat and Poultry Inspection Manual should be deleted.

In all 12 plants, the tongue inspection and reinspection procedures were not changed during the study. Therefore, the objectives were only to randomly select and thoroughly examine the tongues for threadworms. Another objective of the study was to collect tissue samples for laboratory examinations to determine if histopathological

conditions exist in the tongues that would reveal the presence of
G. pulchrum.

BACKGROUND

Gongylonema Pulchrum

G. pulchrum is a small, filiform worm(threadworm), which has been reported to be found in the esophagus and tongue of various species including cattle, sheep,goats, swine, rabbits, horses, deer, bears, and buffaloes in most parts of the world including the United States.

This worm, in its adult stage, is about 30-145 mm. long and may be found in or under the mucosa of the esophagus and tongue, where it appears in a typical spiral or zigzag form. In the esophagus, it may be found parallel to the esophagus' long axis; in the tongue, it may be found among the papillae at the base of the tongue, or on the sides of the tongue' s base.

The adult worms live in or under the mucosa of the esophagus or tongue of the definitive host--cattle, swine,etc--where they deposit their eggs. The eggs are swallowed by the host and passed in the feces as first-stage larvae. If these larvae are ingested by an intermediate host--adult or larval coprophagous beetle, cockroach--they hatch and develop to third-stage infective larvae within 30 days. These larvae may be found encapsulated in the body cavity of the intermediate host. The definitive host becomes infected by ingesting an infected intermediate host. In the definitive host's stomach, the third-stage infective larvae excyst and develop to the fourth-stage larvae, which migrate to the esophagus and tongue,and

lie in or under the mucosa where they become adult worms.

G. pulchrum is a harmless parasite noninfectious to man. Its presence in the esophagus or tongue constitutes a localized condition which generally does not appear to set up an inflammatory process. Nevertheless, the worm can be detected by careful observation of affected tissues. Affected organs may be passed for food after removal of the parasite.

Study of 1967-1970

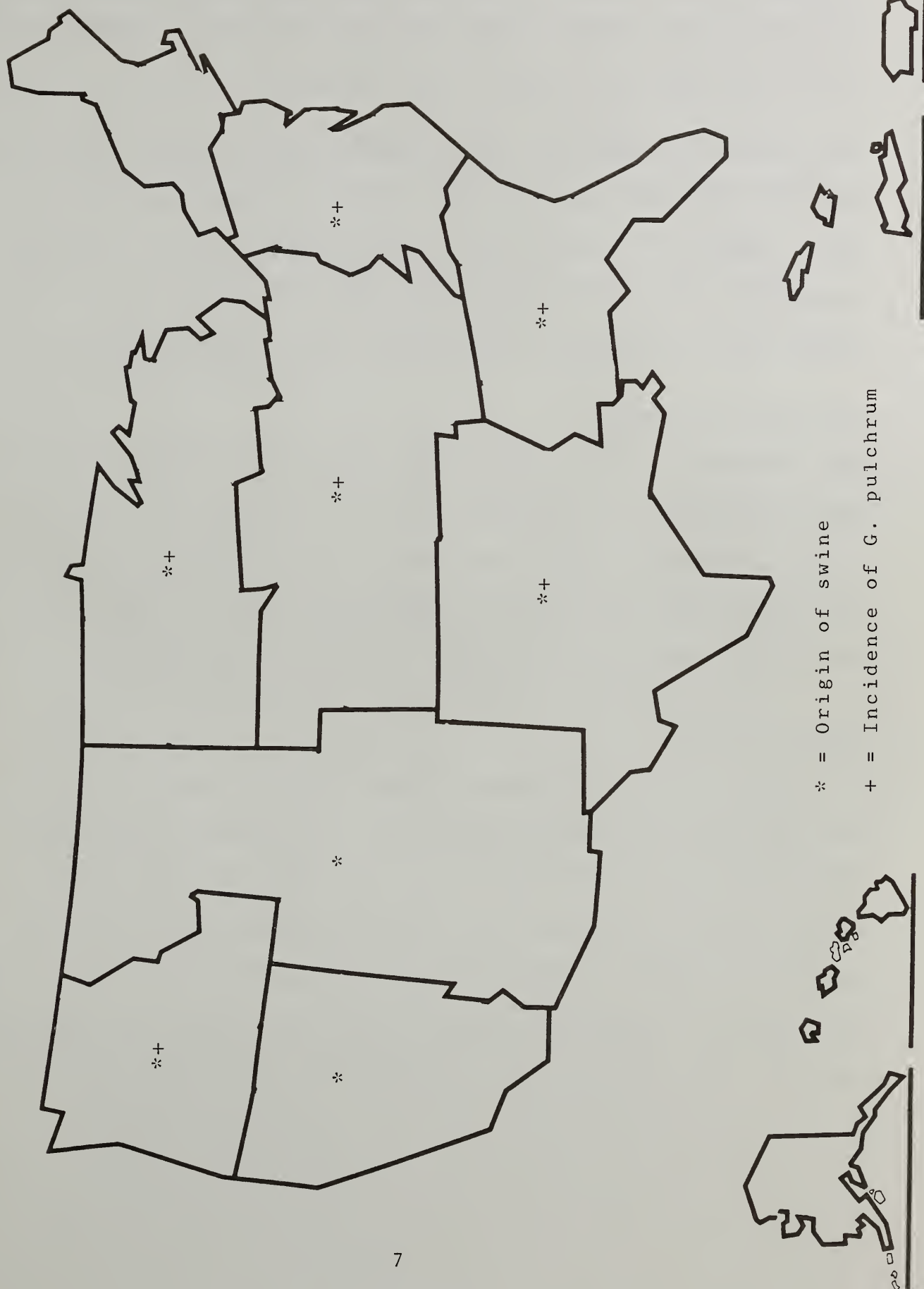
Between 1967 and 1970, PED conducted a study on specimens of tongues from swine from eight geographic regions of the United States (see Table 1) and slaughtered in 18 plants operating under Federal inspection. The histopathological examinations of this study revealed that 5.9 percent of the specimens examined were positive for *G. pulchrum*.

Scalding of Tongues

Before the 1967-1970 study, USDA required a gross examination of the tongues with the aid of curved combing devices or other mechanical tools for detecting the threadworms. As a result of that study, USDA published the following requirements in the Meat and Poultry Inspection Manual:

" Since pork tongues are commonly affected with threadworms, all tongues used in meat food products or labeled as pork tongues for shipping shall be scalded and have the mucosa completely removed.

Table 1 - U.S. Geographic Regions; 1967-1970 Study



Unscalded pork tongues may be shipped, provided they are labeled unscalded pork tongues. They must not be used as edible product unless scalded ".

The purpose of scalding swine tongues is to remove the mucous membrane and make any possible infested tongue free of the threadworm. Removal of the mucosa can be accomplished by scalding the tongues in water at a temperature of 145⁰ F. or higher, then drenching the tongues in cold water and stripping the mucosa.

Incidence Decrease

The incidence of *G. pulchrum* has apparently decreased in the last decades because of improved techniques in breeding and raising swine, including changes from dirt lots to confinement raising and the use of new anthelmintic compounds, which are safe, easy to administer, and highly effective on various parasites.

Responsibility

The Federal Meat and Poultry Inspection Acts require that inspectors perform inspection and reinspection of carcasses and organs of livestock and poultry. The primary purpose of inspection is to detect signs of diseases and other abnormal conditions that may render carcasses, or some of their organs, unfit for human food. Carcasses or organs determined to be unwholesome are condemned and properly disposed of under inspector's supervision.

USDA has many responsibilities. One of them is to maintain, design, and develop the most effective and productive methods of inspecting animals at slaughter. To accomplish this, special studies are routinely conducted by SISP to evaluate the existing inspection systems, to design and develop new systems, and to determine and compare the effectiveness and productivity of existing and new systems. During these studies, thousands of carcasses and organs are inspected by trained inspectors and are then carefully evaluated by veterinary medical officers.

SISP has been developing changes in inspection, based on current disease incidence and extensive implant studies, to meet today's needs and make the inspection system more effective for the new technology and the increased food supply demand of the Nation. As new systems are designed, they are refined through field testing to assure that they guarantee the same level of wholesomeness obtained with the current systems.

Post-mortem inspection requires a large portion of USDA's budget. Therefore, USDA's ongoing responsibility for productive utilization of its resources is especially important with respect to post-mortem inspection. A failure to use the most productive inspection procedures could result in costs to the American consumers which would be significantly higher than necessary.

SISP conducted a series of studies in 12 plants operating under Federal inspection. These studies were essential in determining whether the incidence of the threadworm *G. pulchrum* changed during the past two decades.

Routine Inspection

Routine post-mortem inspection of swine is divided into three phases: head inspection, viscera inspection, and carcass inspection. During each phase, inspectors perform specific tasks, which involve a sequence of observing, palpating, and incising tissues and lymph nodes. These tasks have proved to be an effective and productive method of inspection.

Number of Inspectors

In general, the number of inspectors assigned to swine post-mortem inspection at a plant is related to the size of the plant and the speed of operation. In small plants with a slow slaughter rate, one inspector may complete all inspection tasks; in larger plants with faster line speeds, two or more inspectors complete the tasks. At seven of the test plants, routine post-mortem inspection was carried out by two or more inspectors; at the other five plants, it was completed by one inspector.

METHODOLOGY

The study was conducted simultaneously with another study in five plants. In the other seven plants, it was conducted separately.

Designation of Experts

Scientific and technical experts from various programs and areas of the United States were designated and formed a study team. This team was divided into planning and evaluation staff and inplant testing staff. The first group designed and developed the necessary tasks of evaluation. The second group conducted the inplant evaluations and collected the necessary data.

Plant Selection and Type

Plant selection was based on several factors, including adequate facilities, equipment, and space to conduct the necessary evaluations; line speed and daily slaughter volume sufficient to evaluate the required number of units; disease incidence in animals slaughtered; location; and plant management attitude.

From all swine slaughter plants operating under Federal inspection, a group of 30 was identified. This group was subsequently reduced to 15 which, after examining their blueprints, were visited and reviewed by the project manager to determine their feasibility for conducting the necessary evaluations. Twelve of the 15 plants reviewed were finally selected.

Each selected plant was identified with a number from 1 to 12, depending upon where the evaluations were done first, second, etc. However, in plants 8 to 12, evaluations were done simultaneously within a 4-week period.

The study was conducted at the following types of plants:

Plant No.	Type of Animals	Line Speed/Hr.
1	Market Hogs	790
2	Market Hogs	400
3	Market Hogs	900
4	Sows/Boars	360
5	Market Hogs	1055
6	Market Hogs	780
7	Market Hogs	540
8	Market Hogs	25
9	Market Hogs/Sows	20
10	Market Hogs	135
11	Market Hogs	10
12	Market Hogs	35

Presentation and Inspection

The methods of presenting heads, viscera, and carcasses for inspection and the steps or sequence of the inspection procedures were not affected by the evaluation process; therefore, they were not changed during the study.

Training

Before evaluation, training of inspection personnel was necessary. Therefore, the project manager conducted on-the-job training meetings and trained veterinary medical officers(VMO's) and food inspectors(FI's) to perform the evaluations. In some plants, he trained the inspectors in charge, who then trained other involved inspection personnel.

Evaluation

Evaluation site and evaluators. Evaluations were conducted immediately after inspection or as instructed by the project manager. To examine the tongues, one evaluation site was used at each plant. This site was next to or down the line from the head boning station. In some plants, it was next to the head inspection station.

At the tongue evaluation site, because of different facility layouts and line speeds, one or two evaluators examined the tongues: in seven plants, two VMO's; in three plants, one VMO and one FI; in one plant, one FI; and in one plant, one VMO.

Evaluators' assignment. In five plants, where the study was conducted simultaneously with another study, the evaluators' assignment was different from that used in the other seven plants. Each day, before the beginning of the evaluation, the project manager wrote the abbreviation codes of the VMO's assignments on separate pieces of paper, folded those pieces of paper and randomly selected them to

determine who would serve as an evaluator in one or the other study. Therefore, evaluation of the sampled units was accomplished by following a rotational system. This gave the evaluators an opportunity to participate in both studies. In the other seven plants, assignment rotation was not possible.

Evaluation review. Before the beginning of each evaluation, the project manager reviewed the methods of presenting the units for evaluation and instructed designated plant representatives to make any adjustments, if necessary. Then, he instructed the evaluators to perform the designated tasks. He delayed the beginning of the evaluation until he reviewed and determined that all units were properly presented for evaluation and the evaluators were confident in the evaluation process.

Procedure of evaluation. The inspection procedures were performed by inspection personnel regularly assigned to the test plants. The evaluation procedures were performed by different inspection personnel, except in five plants, where regularly assigned personnel performed the inspection and evaluation tasks.

The carcasses were scalded(or skinned), shaved, cleaned, and eviscerated while suspended from a moving or stationary rail. After they were inspected and passed for human consumption, the tongues were freed from the heads, placed on moving conveyors or stationary pans, and presented for evaluation. In one plant, since the tongues were

not saved for edible purposes, they were left attached to the heads until the heads were boned out and passed for inedible use. In this plant, an evaluator first removed the tongue from the head, then he carefully examined it for threadworms.

As instructed by the project manager, the evaluators examined the tongues by grasping, turning, and carefully observing all tongue surfaces for threadworm infestations.

Tasks of evaluation. The tasks of inplant evaluation were:

A. Plant employee(s):

1. Removed/freed tongues from heads.
2. Palpated, incised tongues(for abscesses) as required.
3. Presented tongues for evaluation.

B. Evaluator(s):

1. Randomly selected and thoroughly examined tongues.
2. Identified/retained suspect tongues.
3. Randomly selected tongues for scalding.
4. Scalded required number of tongues, removed mucosa, and carefully examined tongues and mucosa. Tongues were scalded in water at a temperature of 140⁰- 150⁰ F. for 5-15 minutes.
5. Recorded number of tongues examined.
6. Randomly selected tongues for the laboratory.
7. Prepared specimens and forms for the laboratory.
8. Submitted specimens in formalin jars to the laboratory.

9. Identified and recorded origin of animals slaughtered.

10. Recorded number of animals slaughtered during the evaluations.

Sampling

Selection of units. At the tongue evaluation site, one unit consisted of one tongue. The project manager determined where and how the units were to be selected, notified the veterinary inspector in charge, the inspectors, and plant representatives, and instructed the evaluators when to begin the evaluations.

After the units were freed from the heads, they were closely examined by the evaluators, who were located next to or down the line from the head boning stations. The units were selected as randomly as possible throughout the day's operation and included units from carcasses of swine as slaughtered and presented for inspection during the study.

The evaluators examined the units for threadworms and assured that any information pertaining to the evaluation process was properly recorded. To keep track of how many units were evaluated, the evaluators recorded the number of units as they were examined, re-examined, scalded, and sampled for the laboratory. When the evaluators completed the first unit, they selected the next one as it became available, examined it, and recorded the necessary information. The remaining units were selected(examined and recorded)

as they became available until the required number of units was examined and recorded. The evaluators also had the option of retaining the units, when necessary, for closer examination. If evaluation of a unit revealed a disease or condition requiring condemnation of the unit or part of the unit, appropriate action was taken.

Number of units. Table 2 shows the units examined and the hogs slaughtered during the implant studies. In each of seven plants, each day for 6 days, the evaluators randomly selected and evaluated 1,000 units, including 100 which were scalded and carefully re-examined while the mucosa was peeled off; and 20, which were also carefully re-examined before specimens were randomly selected from them and submitted to the laboratory. In five plants, within 4 weeks, 6,000 units were evaluated, which included 600 units scalded, peeled, and re-examined, and 120 units from which specimens were submitted to the laboratory.

A total of 48,000 units were evaluated during the study. These units included 4,800 units, which were first evaluated, then scalded and re-examined while the mucosa was manually peeled off, and 960 units-- 820 normal and 140 suspect--which were examined and re-examined before specimens were removed from them and submitted to the laboratory.

Table 2 - Units and Swine Sampled

Plant No.	Units Evaluated		Laboratory Samples	Swine <u>1/</u> Slaughtered
	Fresh	Scalded		
1	6,000	600	120	33,180
2	6,000	600	120	16,800
3	6,000	600	120	37,800
4	6,000	600	120	15,120
5	6,000	600	120	44,310
6	6,000	600	120	32,760
7	6,000	600	120	22,680
8	300	30	10	300
9	1,200	120	34	1,200
10	3,300	330	66	5,220
11	500	50	10	580
12	700	70	--	700
Total	48,000	4,800	960	210,650

1/ Total swine slaughtered during inplant studies

Origin of Units

The animals slaughtered during the inplant studies were from the following 32 States (see also Table 3) and the provinces of Alberta and Ontario, Canada:

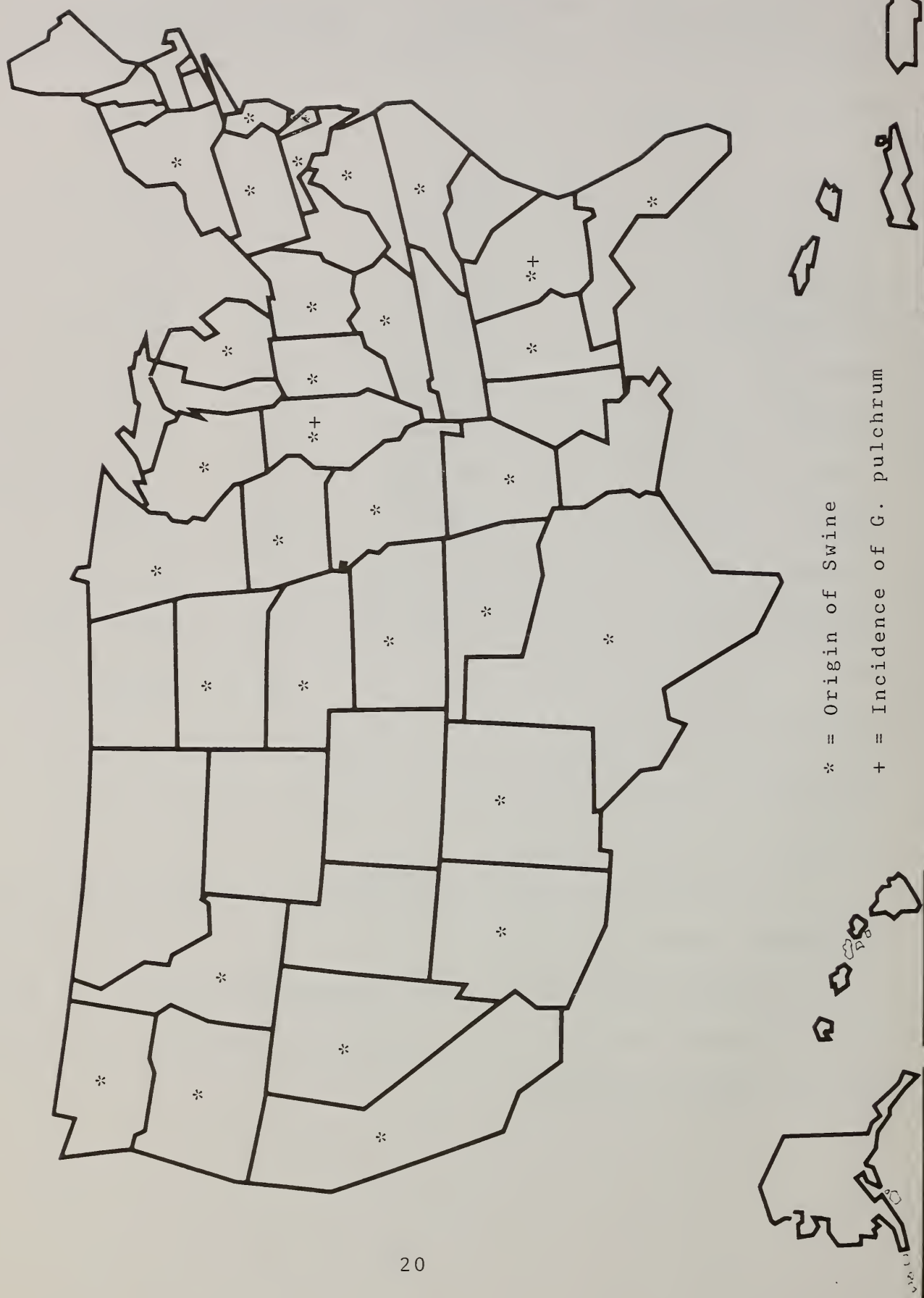
Alabama	Kansas	New York
Arizona	Kentucky	North Carolina
Arkansas	Maryland	Ohio
California	Michigan	Oklahoma
Delaware	Minnesota	Oregon
Florida	Missouri	Pennsylvania
Georgia	Nebraska	South Dakota
Idaho	Nevada	Texas
Illinois	New Jersey	Virginia
Indiana	New Mexico	Washington
Iowa		Wisconsin

Test Variability

To prevent or reduce variability and bias, the evaluation process was based on the following:

1. The evaluators were instructed to randomly select and thoroughly examine the units.
2. During the evaluation and recording of the units, the project manager reviewed, as frequently as possible, the sampling and evaluation procedures.

Table 3 - Study of 1987-1989



3. The units were so evaluated that carcasses of animals from the same lots were used.

4. The evaluations were spaced out during the study.

5, Where possible, the evaluators alternated duties.

Limitations

The evaluations were conducted at 12 plants, which were not randomly selected. Any inferences to other plants would be judgmental.

RESULTS

All data collected during the inplant evaluations were reviewed, analyzed, and summarized. Of the 48,000 tongues that were carefully examined in the 12 test plants, 140 were identified with lesions suspect of being caused by *G. pulchrum*. Specimens from these tongues and from 820 randomly selected normal tongues--a total of 960 specimens--were submitted to the laboratory.

The results of the histopathological examinations on the 140 specimens from suspect tongues revealed the presence of *G. pulchrum* in one specimen and eggs in another specimen. A total of two specimens were confirmed by the laboratory as being positive for this threadworm. One was from swine which were slaughtered in Plant No. 4 (see Table 2) and were from the following States (and Ontario, Canada): Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, South Dakota, and Wisconsin. The other specimen was from swine which were slaughtered in Plant No. 7 and were from Alabama, Florida, and Georgia.

The histopathological examinations performed on the specimens from the 820 randomly selected normal tongues were negative.

CONCLUSION AND RECOMMENDATION

The extensive inplant and laboratory evaluations performed during this study revealed that the incidence of *G. pulchrum* in swine has changed in the United States since the 1960's, and has decreased to an insignificant occurrence because of improved animal raising conditions and use of effective anthelmintic preparations.

The inplant evaluations of 48,000 tongues, randomly selected from 210,650 carcasses, and the evaluations of 4,800 tongues, which were examined, scalded, and re-examined while the mucosa was manually peeled off, did not reveal the presence of this worm. The histopathological examinations on specimens from 960 randomly selected tongues--820 normal and 140 suspect--revealed the presence of the worm only in one specimen and eggs in another specimen.

The main reason for scalding swine tongues is to remove the mucous membrane and assure that any threadworm, if present, is also removed. *G. pulchrum* is a small, filiform parasite, noninfectious to man, which may be found by close observation in the esophagus and tongue of carcasses of animals including cattle, sheep, goats, swine, rabbits, horses, deer, bears, and buffaloes. As the results of this study indicate, the incidence of this threadworm in swine tongues is now insignificant in the United States; therefore, it is recommended that USDA delete the requirement of scalding these tongues, and emphasize the reinspection requirements including

observation of tongues for threadworms.

As required by the Meat and Poultry Inspection Manual, plant management should assure that its employees, to detect abscesses, carefully palpate and observe the tongues from market hogs, and palpate, incise the ventral surface, and observe the tongues from sows, stags, or boars. Supervisory inspection personnel should assure that, while the tongues are still warm, inspectors thoroughly examine about 10 percent, of those passed by plant employees, for abnormalities such as contamination, lacerations, punctures, presence of tonsils, stains, encapsulated abscesses, parasites (threadworms). Tongues affected by these conditions may be passed for food after removal of affected tissues. Stains may be removed by trimming or scalding.

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